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PATENT

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In Re Application of:

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Serial No.: Not Yet Assigned

Group Art Unit: Not Yet Assigned

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For: ARCHITECTURE FOR CUSTOMIZABLE APPLICATIONS

EXPRESS MAIL LABEL NO: EL568025772US  
DATE OF DEPOSIT: October 3, 2000

Box ☒ Patent Application  
☐ Provisional ☐ Design

Assistant Commissioner for Patents  
Washington DC 20231

Sir:

PATENT APPLICATION TRANSMITTAL LETTER

Transmitted herewith for filing, please find

☒ A Utility Patent Application under 37 C.F.R. 1.53(b).

It is a continuing application, as follows:

☐ continuation ☐ divisional ☐ continuation-in-part of prior application number  
\_\_\_\_/\_\_\_\_.

☐ A Provisional Patent Application under 37 C.F.R. 1.53(c).

09/678511-10/03/00

☐ A Design Patent Application (submitted in duplicate).

Including the following:

☐ Provisional Application Cover Sheet.

☒ New or Revised Specification, including pages 1 to 37 containing:

☒ Specification

☒ Claims

☒ Abstract

☐ Substitute Specification, including Claims and Abstract.

☐ The present application is a continuation application of Application No. \_\_\_\_\_ filed \_\_\_\_\_. The present application includes the Specification of the parent application which has been revised in accordance with the amendments filed in the parent application. Since none of those amendments incorporate new matter into the parent application, the present revised Specification also does not include new matter.

☐ The present application is a continuation application of Application No. \_\_\_\_\_ filed \_\_\_\_\_, which in turn is a continuation-in-part of Application No. \_\_\_\_\_ filed \_\_\_\_\_. The present application includes the Specification of the parent application which has been revised in accordance with the amendments filed in the parent application. Although the amendments in the parent C-I-P application may have incorporated new matter, since those are the only revisions included in the present application, the present application includes no new matter in relation to the parent application.

☐ A copy of earlier application Serial No. \_\_\_\_\_ Filed \_\_\_\_\_, including Specification, Claims and Abstract (pages 1 - @@), to which no new matter has been added TOGETHER WITH a copy of the executed oath or declaration for such earlier application and all drawings and appendices. Such earlier application is hereby incorporated into the present application by reference.

- ☐ Please enter the following amendment to the Specification under the Cross-Reference to Related Applications section (or create such a section) : "This Application:
- ☐ is a continuation of ☐ is a divisional of ☐ claims benefit of U.S. provisional Application Serial No. \_\_\_\_\_ filed \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- ☐ Signed Statement attached deleting inventor(s) named in the prior application.
- ☐ A Preliminary Amendment.
- ☒ 10 Sheets of ☒ Formal ☐ Informal Drawings.
- ☐ Petition to Accept Photographic Drawings.
- ☐ Petition Fee
- ☒ An ☐ Executed ☒ Unexecuted Declaration or Oath and Power of Attorney.
- ☐ An Associate Power of Attorney.
- ☐ An ☐ Executed ☐ Copy of Executed Assignment of the Invention to \_\_\_\_\_
- \_\_\_\_\_
- ☐ A Recordation Form Cover Sheet.
- ☐ Recordation Fee - \$40.00.
- ☐ The prior application is assigned of record to \_\_\_\_\_
- ☐ Priority is claimed under 35 U.S.C. § 119 of Patent Application No. \_\_\_\_\_ filed \_\_\_\_\_ in \_\_\_\_\_ (country).
- ☐ A Certified Copy of each of the above applications for which priority is claimed:
- ☐ is enclosed.
- ☐ has been filed in prior application Serial No. \_\_\_\_\_ filed \_\_\_\_\_.

DOCKET NUMBER

- ☐ An ☐ Executed or ☐ Copy of Executed Earlier Statement Claiming Small Entity Status under 37 C.F.R. 1.9 and 1.27
- ☐ is enclosed.
- ☐ has been filed in prior application Serial No. \_\_\_\_\_ filed \_\_\_\_\_, said status is still proper and desired in present case.
- ☐ Diskette Containing DNA/Amino Acid Sequence Information.
- ☐ Statement to Support Submission of DNA/Amino Acid Sequence Information.
- ☐ The computer readable form in this application \_\_\_\_\_, is identical with that filed in Application Serial Number \_\_\_\_\_, filed \_\_\_\_\_. In accordance with 37 CFR 1.821(e), please use the ☐ first-filed, ☐ last-filed or ☐ only computer readable form filed in that application as the computer readable form for the instant application. It is understood that the Patent and Trademark Office will make the necessary change in application number and filing date for the computer readable form that will be used for the instant application. A paper copy of the Sequence Listing is ☐ included in the originally-filed specification of the instant application, ☐ included in a separately filed preliminary amendment for incorporation into the specification.
- ☐ Information Disclosure Statement.
- ☐ Attached Form 1449.
- ☐ Copies of each of the references listed on the attached Form PTO-1449 are enclosed herewith.
- ☐ A copy of Petition for Extension of Time as filed in the prior case.
- ☐ Appended Material as follows: \_\_\_\_\_.
- ☒ Return Receipt Postcard (should be specifically itemized).
- ☐ Other as follows: \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_.

000001-100000

## FEE CALCULATION:

- ☐ Cancel in this application original claims \_\_\_\_\_ of the prior application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

			SMALL ENTITY		NOT SMALL ENTITY	
			RATE	FEE	RATE	FEE
PROVISIONAL APPLICATION			\$75.00	\$	\$150.00	\$
DESIGN APPLICATION			\$160.00	\$	\$320.00	\$
UTILITY APPLICATIONS BASE FEE			\$355.00	\$	\$710.00	\$ 710.00
UTILITY APPLICATION; ALL CLAIMS CALCULATED AFTER ENTRY OF ALL AMENDMENTS						
	No. Filed	No. Extra				
TOTAL CLAIMS	50- 20 =	30	\$9 each	\$	\$18 each	\$ 540.00
INDEP. CLAIMS	7- 3 =	4	\$40 each	\$	\$80 each	\$ 320.00
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM			\$135	\$	\$270	\$
ADDITIONAL FILING FEE				\$		\$
TOTAL FILING FEE DUE				\$		\$1,570.00

- ☒ A Check is enclosed in the amount of \$ 1,570.00 .
- ☒ The Commissioner is authorized to charge payment of the following fees and to refund any overpayment associated with this communication or during the pendency of this application to deposit account 23-3050. This sheet is provided in duplicate.
- ☐ The foregoing amount due.
- ☒ Any additional filing fees required, including fees for the presentation of extra claims under 37 C.F.R. 1.16.
- ☒ Any additional patent application processing fees under 37 C.F.R. 1.17 or 1.20(d).
- ☐ The issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance.



**ARCHITECTURE FOR CUSTOMIZABLE APPLICATIONS****FIELD OF THE INVENTION**

The present invention relates generally to the field of computing. More particularly, the invention is directed to the customization of software applications.

**BACKGROUND OF THE INVENTION**

As the computer industry has grown, numerous commercial software products have become available. It is now possible to buy "off-the-shelf" software for a variety of applications. However, off-the-shelf software has a significant drawback: it comes pre-configured to perform actions in a certain way – that is, it comes with a pre-determined "model" of the task that it is designed to perform. Unfortunately, computer users' needs do not always fit neatly into that model. Stated succinctly, when it comes to software, one size does not fit all.

For example, a user may purchase an off-the-shelf program to prepare invoices for a business. One of the functions performed by the program may be the computation of sales tax for the invoice, and the program may be designed with the understanding that the applicable tax rate is based on the state in which the sale occurred. The program, however, may be designed with the assumption a tax rate is uniform throughout a given state, and thus may be unable to compute sales tax in states where the tax rate varies by zip code. Moreover, since the program is delivered to the user as a self-contained, fixed set of instructions, there may be no way to add to the program the instructions that would compute the sales tax based on the zip code. In this case, the off-the-shelf program almost fits what the user needs to do, and yet the program is effectively unsuitable for the user's invoice needs, because the program's "model" of how to compute sales tax does not quite do what the user needs, and cannot be extended to do so. What is

1 needed in this example is the ability to customize the off-the-shelf invoice program  
2 to compute sales tax according to whatever formula a user might need.

3           There are various solutions to the problem of customizing software,  
4 none of which are completely satisfactory. For example, it is common practice in  
5 the field of business software for the manufacturer of the software to rewrite a base  
6 program (e.g., an invoice program) to a customer's specifications. The customer's  
7 requirements are inserted into the source code by the manufacturer, the source code  
8 is recompiled, and a custom-built piece of software is delivered to the customer.  
9 This solution has the drawbacks that: (1) it is labor-intensive; and (2) there may be  
10 no consistency in the manner in which modifications to the original base program  
11 are performed, which makes it difficult to service and upgrade the custom-built  
12 programs.

13           Another solution is to use an interpretable script-type language for  
14 the application, in which case the source code is available to the user and  
15 customizations can be added as needed. Interpreted programs, however, are slower  
16 than compiled programs, and an interpreted program may not be able to meet the  
17 stringent performance requirements that apply in some circumstances.

18           Moreover, there do not currently exist any well-defined techniques or  
19 methods to customize applications that are built upon many "tiers" of machines and  
20 distributed via a loosely coupled, wide area network (typically the Internet). Prior  
21 systems that support some type of customization, such as Visual Basic for  
22 Applications (VBA), are most appropriate for desktop applications (such as the  
23 MICROSOFT EXCEL spreadsheet, or the MICROSOFT WORD word processor),  
24 and those techniques are not well suited for distributed applications.

25           In view of the foregoing, there is clearly a need for a system that  
26 overcomes the limitations and drawbacks of the prior art.

27



**SUMMARY OF THE INVENTION**

The invention provides a system and method for the customization of applications, and an environment in which customized applications may execute. A customized application includes an “application object” and a “customization.”

The “application object” is a software component that contains logic to implement a generalized process, and the “customization” implements specific logic that causes the application object to behave in a certain “customized” manner for a given instantiation of the application object. For example, an application object may implement the general process of preparing an invoice, and a customization designed to work with that application object may compute the sales tax for the invoice based on zip codes. A “business object” is a particularly useful type of application object that implements a business process (such as preparing an invoice), although application objects are not limited to business processes.

The application object includes a type of interface called a “public object model.” The public object model includes a set of “events” that are “fired” by the application object during its execution, as well as the information that is necessary for a customization to be able to interact with these events. The public object model for a given application object is made available to the public at large, so that programmers can write customizations that work with the application object. A customization takes the form of a set of code sequences that are to be executed when particular events are fired by the application. As the application object executes, it fires events, which are processed by an event handler. In response to a given event, the event handler invokes the appropriate code from the customization.

Customizations are stored in a “customization store,” which is preferably (but not mandatorily) a database. There may be numerous customizations that can work with a given application object, and storage of these customizations in a database allows for convenient and efficient retrieval of an appropriate customization. The customization itself preferably takes the form of machine-

1 executable binary code (i.e., code that has already been compiled); one advantage  
2 of storing customizations in machine-executable form rather than in the form of  
3 interpretable scripts is that machine-executable code can be executed more quickly.  
4 A "script engine" may be used to convert textual (i.e., high-level) descriptions of  
5 the customizations into machine-executable form.

6 Each customization stored in the database is indexed by a "moniker."  
7 The moniker is a label that identifies the customization in the customization store  
8 (e.g. database). Preferably, the moniker is a string that identifies at least the  
9 application object to which the customization relates, and the user for whom it has  
10 been customized, although the moniker may contain other (or entirely different)  
11 elements. As one example, the application object may be part of a module of an  
12 application that has been installed for use by a particular company, and each  
13 customization may be particular to a department of the company and a user in the  
14 department. In this case, the moniker may have several fields, separated by slashes,  
15 of the form:

16  
17 CompanyName://ApplicationName/Module/ApplicationObjName/Dept/User  
18

19 The business object may construct the moniker based both on fixed data as well as  
20 context. For example, an application object may comprise fixed data that specifies  
21 the company, application, and module of which it is a part, as well as its own name,  
22 and that same application object may contain code to derive the relevant department  
23 and username from the context in which it is executing.

24 Other features of the invention are described below.  
25

#### 26 **BRIEF DESCRIPTION OF THE DRAWINGS**

27 The foregoing summary, as well as the following detailed description  
28 of preferred embodiments, is better understood when read in conjunction with the

1 appended drawings. For the purpose of illustrating the invention, there is shown in  
2 the drawings exemplary constructions of the invention; however, the invention is  
3 not limited to the specific methods and instrumentalities disclosed. In the drawings:

4 FIG. 1 is a block diagram of an exemplary computing environment in  
5 which aspects of the invention may be implemented;

6 FIG. 2 is a block diagram of an exemplary multi-tier architecture in  
7 which aspects of the invention may be implemented;

8 FIG. 3 is a block diagram of an exemplary environment for a  
9 customizable application object in accordance with the invention;

10 FIG. 4 is a diagram showing an aspect of the structure of code in an  
11 application object, in accordance with the invention;

12 FIG. 5 is a block diagram showing an exemplary structure of  
13 customized code;

14 FIG. 6 is a block diagram showing an exemplary structure of a  
15 customization store;

16 FIG. 7 is a flow diagram showing an exemplary process of using a  
17 customizable application object;

18 FIG. 8 is a diagram showing an exemplary structure of a moniker in  
19 accordance with aspects of the invention;

20 FIG. 9 is a block diagram showing an application object within an  
21 environment having attributes;

22 FIG. 10 is a flow diagram showing an exemplary process for the  
23 construction of a moniker string;

24 FIG. 11 is a block diagram showing an exemplary lookup object  
25 which may be used to locate customizations identified by monikers; and

26 FIG. 12 is a flow diagram showing an exemplary process by which  
27 customized code may be created and stored.

28

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

### Overview

Numerous commercial software applications are available for today's computer users. Consumers can find commercially-available software to address a vast array of computing needs. While software has become increasingly versatile, it is not possible for the designers of a given commercial software product to anticipate each and every specialized need that a software consumer might have. Customizable software allows consumers to extend the functionality of off-the-shelf applications to fit a wider variety of needs.

### An Exemplary Computing Environment

FIG. 1 illustrates an example of a suitable computing system environment 100 in which the invention may be implemented. The computing system environment 100 is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the invention. Neither should the computing environment 100 be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment 100.

The invention is operational with numerous other general purpose or special purpose computing system environments or configurations. Examples of well known computing systems, environments, and/or configurations that may be suitable for use with the invention include, but are not limited to, personal computers, server computers, hand-held or laptop devices, multiprocessor systems, microprocessor-based systems, set top boxes, programmable consumer electronics, network PCs, minicomputers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

1           The invention may be described in the general context of computer-  
2   executable instructions, such as program modules, being executed by a computer.  
3   Generally, program modules include routines, programs, objects, components, data  
4   structures, etc. that perform particular tasks or implement particular abstract data  
5   types. The invention may also be practiced in distributed computing environments  
6   where tasks are performed by remote processing devices that are linked through a  
7   communications network or other data transmission medium. In a distributed  
8   computing environment, program modules and other data may be located in both  
9   local and remote computer storage media including memory storage devices.

10           With reference to FIG. 1, an exemplary system for implementing the  
11   invention includes a general purpose computing device in the form of a computer  
12   110. Components of computer 110 may include, but are not limited to, a processing  
13   unit 120, a system memory 130, and a system bus 121 that couples various system  
14   components including the system memory to the processing unit 120. The system  
15   bus 121 may be any of several types of bus structures including a memory bus or  
16   memory controller, a peripheral bus, and a local bus using any of a variety of bus  
17   architectures. By way of example, and not limitation, such architectures include  
18   Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus,  
19   Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local  
20   bus, and Peripheral Component Interconnect (PCI) bus (also known as Mezzanine  
21   bus).

22           Computer 110 typically includes a variety of computer readable  
23   media. Computer readable media can be any available media that can be accessed  
24   by computer 110 and includes both volatile and nonvolatile media, removable and  
25   non-removable media. By way of example, and not limitation, computer readable  
26   media may comprise computer storage media and communication media. Computer  
27   storage media includes both volatile and nonvolatile, removable and non-removable  
28   media implemented in any method or technology for storage of information such as

1 computer readable instructions, data structures, program modules or other data.  
2 Computer storage media includes, but is not limited to, RAM, ROM, EEPROM,  
3 flash memory or other memory technology, CDROM, digital versatile disks (DVD)  
4 or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk  
5 storage or other magnetic storage devices, or any other medium which can be used  
6 to store the desired information and which can accessed by computer 110.  
7 Communication media typically embodies computer readable instructions, data  
8 structures, program modules or other data in a modulated data signal such as a  
9 carrier wave or other transport mechanism and includes any information delivery  
10 media. The term "modulated data signal" means a signal that has one or more of its  
11 characteristics set or changed in such a manner as to encode information in the  
12 signal. By way of example, and not limitation, communication media includes wired  
13 media such as a wired network or direct-wired connection, and wireless media such  
14 as acoustic, RF, infrared and other wireless media. Combinations of any of the  
15 above should also be included within the scope of computer readable media.

16 The system memory 130 includes computer storage media in the  
17 form of volatile and/or nonvolatile memory such as read only memory (ROM) 131  
18 and random access memory (RAM) 132. A basic input/output system 133 (BIOS),  
19 containing the basic routines that help to transfer information between elements  
20 within computer 110, such as during start-up, is typically stored in ROM 131. RAM  
21 132 typically contains data and/or program modules that are immediately accessible  
22 to and/or presently being operated on by processing unit 120. By way of example,  
23 and not limitation, FIG. 1 illustrates operating system 134, application programs  
24 135, other program modules 136, and program data 137.

25 The computer 110 may also include other removable/non-removable,  
26 volatile/nonvolatile computer storage media. By way of example only, FIG. 1  
27 illustrates a hard disk drive 140 that reads from or writes to non-removable,  
28 nonvolatile magnetic media, a magnetic disk drive 151 that reads from or writes to

1 a removable, nonvolatile magnetic disk 152, and an optical disk drive 155 that reads  
2 from or writes to a removable, nonvolatile optical disk 156, such as a CD ROM or  
3 other optical media. Other removable/non-removable, volatile/nonvolatile computer  
4 storage media that can be used in the exemplary operating environment include, but  
5 are not limited to, magnetic tape cassettes, flash memory cards, digital versatile  
6 disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard  
7 disk drive 141 is typically connected to the system bus 121 through an non-  
8 removable memory interface such as interface 140, and magnetic disk drive 151 and  
9 optical disk drive 155 are typically connected to the system bus 121 by a removable  
10 memory interface, such as interface 150.

11 The drives and their associated computer storage media discussed  
12 above and illustrated in FIG. 1, provide storage of computer readable instructions,  
13 data structures, program modules and other data for the computer 110. In FIG. 1,  
14 for example, hard disk drive 141 is illustrated as storing operating system 144,  
15 application programs 145, other program modules 146, and program data 147. Note  
16 that these components can either be the same as or different from operating system  
17 134, application programs 135, other program modules 136, and program data 137.  
18 Operating system 144, application programs 145, other program modules 146, and  
19 program data 147 are given different numbers here to illustrate that, at a minimum,  
20 they are different copies. A user may enter commands and information into the  
21 computer 20 through input devices such as a keyboard 162 and pointing device 161,  
22 commonly referred to as a mouse, trackball or touch pad. Other input devices (not  
23 shown) may include a microphone, joystick, game pad, satellite dish, scanner, or  
24 the like. These and other input devices are often connected to the processing unit  
25 120 through a user input interface 160 that is coupled to the system bus, but may be  
26 connected by other interface and bus structures, such as a parallel port, game port  
27 or a universal serial bus (USB). A monitor 191 or other type of display device is  
28 also connected to the system bus 121 via an interface, such as a video interface 190.

1 In addition to the monitor, computers may also include other peripheral output  
2 devices such as speakers 197 and printer 196, which may be connected through an  
3 output peripheral interface 190.

4 The computer 110 may operate in a networked environment using  
5 logical connections to one or more remote computers, such as a remote computer  
6 180. The remote computer 180 may be a personal computer, a server, a router, a  
7 network PC, a peer device or other common network node, and typically includes  
8 many or all of the elements described above relative to the computer 110, although  
9 only a memory storage device 181 has been illustrated in FIG. 1. The logical  
10 connections depicted in FIG. 1 include a local area network (LAN) 171 and a wide  
11 area network (WAN) 173, but may also include other networks. Such networking  
12 environments are commonplace in offices, enterprise-wide computer networks,  
13 intranets and the Internet.

14 When used in a LAN networking environment, the computer 110 is  
15 connected to the LAN 171 through a network interface or adapter 170. When used  
16 in a WAN networking environment, the computer 110 typically includes a modem  
17 172 or other means for establishing communications over the WAN 173, such as the  
18 Internet. The modem 172, which may be internal or external, may be connected to  
19 the system bus 121 via the user input interface 160, or other appropriate  
20 mechanism. In a networked environment, program modules depicted relative to the  
21 computer 110, or portions thereof, may be stored in the remote memory storage  
22 device. By way of example, and not limitation, FIG. 1 illustrates remote application  
23 programs 185 as residing on memory device 181. It will be appreciated that the  
24 network connections shown are exemplary and other means of establishing a  
25 communications link between the computers may be used.

#### 26 27 Multi-tiered Environments

28 It is often useful for computing applications to function in a



1 distributed environment. The wide availability of computer networks increases the  
2 speed and connectivity of communication between computers, which ease of  
3 communication that they provide, makes it possible for various functions of a  
4 computing application to be performed by different components that may reside on  
5 different computers. FIG. 2 shows a multi-tiered architecture, which is a  
6 particularly advantageous type of distributed environment for some applications.

7 Referring now to FIG. 2, one or more clients 180a and 180b  
8 communicatively connect to a middle tier object via communications network 173.  
9 Clients 180a and 180b may, for example, be remote computers such as remote  
10 computer 180 shown in FIG. 1. Communications network 173a may be a wide area  
11 network, such as wide-area network 173 shown in FIG. 1. Alternatively,  
12 communications network 173a may be a local area network (such as LAN 171  
13 shown in FIG. 1), or any other means by which computers may communicate.  
14 Client 180a is connected to communications network 173a directly, while client  
15 180b is connected to communications network 173a via proxy/gateway 180c.  
16 Proxy/gateway 180c may be a computer (again, such as remote computer 180)  
17 which executes firewall software, or which otherwise mediates and/or enables  
18 communication between client 180b and communications network 173a.

19 Middle tier object 201 is a software object that executes on a  
20 computer (such as computer 100 shown in FIG. 1). Middle tier object may fulfill  
21 the role of a "server," in that it provides services that are sought by clients 180a  
22 and 180b. As shown in FIG. 2, middle tier object 201 is communicatively  
23 connected to communications network 173a by means of which it may communicate  
24 with clients 180a and 180b. For example, clients 180a and 180b may request  
25 services or information from middle tier object 201 through communications  
26 network 173a, and middle tier object 201 may provide responsive data through that  
27 same network.

28 Middle tier object 201 may be associated with back end object such

1 as database 202. Database 202 is a “back-end” object in the sense that it does not  
2 communicate directly with clients 180a and 180b, which is to say that its  
3 functionality is not directly exposed to the clients. For example, clients 180a and  
4 180b may be able to submit high-level requests for information to middle-tier object  
5 201, and middle-tier object 201 may, in turn, submit low-level database lookup and  
6 retrieval requests to database 202. Middle-tier object may then organize the  
7 retrieved information in a format that is useful to clients 180a and 180b and then  
8 transmit that information to them, without exposing the details of the database  
9 lookup operation to clients 180a and 180b. In this way, the use of “back-end”  
10 objects allows middle-tier object 201 to provide clients 180a and 180b with a high-  
11 level abstraction of the function that middle-tier object 201 performs.

12 Database 202 may be physically located on the same computing  
13 device as middle-tier object 201, or it may be located on a different computing  
14 device. If database 202 is located on a different computing device, then a  
15 communications means (not shown) is used to connect database 202 with the  
16 computing device that hosts middle tier object 201. Communications network 173a  
17 may be used as this communications means, although doing so may make back-end  
18 database 202 directly accessible to clients 180a and 180b, which may be  
19 disadvantageous for some applications.

20 While FIG. 2 shows clients 180a and 180b connected to middle-tier  
21 object 201 via a communications network 173a, it may be the case that all objects  
22 may reside on a single multi-tasking computer. For example, clients 180a and 180b,  
23 and middle-tier object 201, may all reside on a single computer and each have their  
24 own allotment of addressable memory and processor time, in which case interaction  
25 between the object may take place via interprocess communication means instead of  
26 communications network 173. In such a case, the various objects shown in FIG. 2  
27 represent a convenient division of components of a system rather than a distribution  
28 of functions among different computers.

1

2 Environment for Customizable Applications

3           FIG. 3 shows an exemplary architecture for a customizable  
4 application. Application 300 is a collection of one or more software components  
5 that performs one or more functions. For example, application 300 may be an  
6 accounting system that generates invoices, payments, reports, etc., for a business.  
7 Application 300 may be a single self-contained computer program, but it is  
8 preferably a collection of individual “application objects,” each of which performs a  
9 discrete function. For example, application 300 may be a suite of accounting  
10 programs (perhaps with a common “front-door” interface provided by application  
11 300), where each separate accounting function (e.g., generation of invoices, writing  
12 checks for payments, generation of reports, etc.) is performed by a separate  
13 application object. Each of the separate objects is, in essence, a middle-tier object  
14 201 (as shown in FIG. 2), in that each application object can operate separately and  
15 can communicate directly with a client, such as client 180.

16           Thus, in FIG. 3, application 300 comprises application object 201a.  
17 For simplicity, a single application object 201a is shown in FIG. 3, although it will  
18 be appreciated that application 300 may actually comprise a plurality of application  
19 objects. Application object 201a comprises an internal object 301 and a public  
20 object model 302. Internal object 301 includes the logic that performs the  
21 application’s basic functions. In general, the logic of internal object 301 is  
22 predetermined: the developer of application object 201a writes a fixed set of  
23 instructions (generally in a source-level language), and internal logic 301 comprises  
24 the machine-executable instructions that result from the compilation of the source-  
25 language instructions written by the developer.

26           Public object model 302 describes those portions of the functionality  
27 of application object 201a that can interact with the world outside of application  
28 object 201a. This functionality can be thought of as “hooks” into application object

1 201a. Public object model 302 may, for example, take the form of an interface into  
2 application object 201a, or, as another example, a self-describing class. Public  
3 object model 302 preferably includes two types of “hooks”: a set of “methods”  
4 311, and a set of “event sources” 312. A “method” is a unit of instructions,  
5 identifiable by a name, which can be invoked on a particular instance of application  
6 object 201a. An “event source” is a description of a method that a customization  
7 (see below) can implement and that application object 201a will invoke at a  
8 particular point in time. It may be convenient to think of certain embodiments of  
9 public object model 302 as including two interfaces: a first interface (sometimes  
10 called the “application interface”) that describes the methods, and a second interface  
11 (sometimes called the “event source” interface) that describes the event sources.  
12 Public object model 302 is “public” in the sense that it is preferably well-known (or  
13 at least publicly available), so that programmers can customize application object  
14 201a by using the public methods and by writing customized code that can be  
15 invoked by the event sources.

16           The relationship between internal object 301 and public object model  
17 302 can best be illustrated as follows. If application object 201a is a program that  
18 prepares invoices, that program may contain logic to display line-items of the  
19 invoice as part of internal object 301. This logic may be predetermined and  
20 unchanging, due to the fact that every invoice has items organized into lines (or,  
21 more precisely, the developer of the program may make this assumption in  
22 designing application object 201a). Application object 201a may also include, as  
23 part of its public object model 302, a public method whose return value is the  
24 subtotal (i.e., the pre-tax total of all line items). Application object 201a may also  
25 “fire” an event once the subtotal has been computed, in order to give programmers  
26 an opportunity to compute the sales tax in a specified manner. The name of the  
27 event, and the fact that it is fired upon computation of the subtotal, is part of public  
28 object model 302. Thus a programmer is given the opportunity to create a custom

1 sale tax computation routine (e.g., one that bases the tax rate on the zip code), by  
2 writing code, identified by the name of the event, that will be invoked upon firing  
3 of that event. Such code may, for example, use the above-mentioned public method  
4 to retrieve the subtotal so that such subtotal can be multiplied by the tax rate in  
5 order to compute the sales tax.

6 It should be observed at this point that public object model 302 is  
7 significant in that it allows a programmer to customize application object 201a  
8 without having access to the source code of application object 201a. It should also  
9 be observed that application object 201a can be revised or updated and, as long as  
10 the revised version has the same public object model 302 as the original version,  
11 customizations written for the old version will work with the new version.

12 FIG. 4 depicts the structure of application object 201a as a collection  
13 of instructions including both predetermined actions 401 and events 312.  
14 Application object 201a includes executable code that executes in a sequence  
15 401(1). FIG. 4 shows a plurality of code sequences 401(1) through 401(n), because  
16 application object 201a may, in fact, have plural threads of execution that execute  
17 concurrently, and thus not all of the code of application object 201a can be viewed  
18 as executing in a single sequence.

19 The executable code in each sequence includes code that performs  
20 one or more predetermined actions 401. Between execution of the predetermined  
21 actions, one or more events 312 may be fired. As described above, events 312 are  
22 part of public object model 302, such that a programmer is given the opportunity to  
23 write code that executes in response to the firing of events 312. Predetermined  
24 actions 401 are essentially part of internal object 301. Predetermined actions 401  
25 execute but do not provide an opportunity for direct interaction with code outside of  
26 application object 201a. Stated another way, predetermined actions 401 are not  
27 directly accessible via public object model 302.

28 Application object 201a also includes public methods 311. Public

1 methods 311 are part of the logic contained in application object 201a. As discussed  
2 above, these methods are also part of public object model 302, and code that is  
3 external to application object 201a may invoke public methods 311. Public methods  
4 311 may also be invoked by sequential code 410(1) through 410(n), but need not be.  
5 For example, a method that returns the subtotal of an invoice may be called by  
6 internal object 301 if retrieving the subtotal is part of a predetermined action 401  
7 that application object 201a performs. However, some public methods 311 are  
8 never invoked by predetermined actions 401 and exist only for the purpose of being  
9 called by customizations 320 (described below).

10 Returning now to FIG. 3, application object is coupled to a database  
11 202. Database 202 serves the function of a “customization store” in that it stores  
12 one or more customizations 320 for application object 201a. A customization is a  
13 unit of code that is designed to work with application object 201a based on public  
14 object model 302. It will be appreciated that, while a database is a convenient  
15 structure for storing customizations, the customization store may be implemented  
16 using any means that are capable of storing and retrieving information. Thus, while  
17 the customization store is referred to herein as “customization store/database 202,”  
18 the customization store is not limited to implementations that use a database. In fact,  
19 as further discussed below in connection with FIG. 11, it is possible to put a layer  
20 of abstraction on top of customization store/database 202 (e.g., by making it  
21 callable either locally or remotely via HTTP and SOAP), such that the nature of  
22 customization store/database 202 and its implementation are transparent to  
23 application object 201a.

24 As shown in FIG. 5, each customization 320 may contain one or  
25 more components 501(1) through 501(n), with each component containing the code  
26 that is invoked upon the firing of a particular event 312. Each component includes a  
27 label or reference 502 to the particular event to which it corresponds, as well as the  
28 code 503 that is actually executed in response to the event. Code 503 is preferably

1 in machine-executable form. Machine-executable form, as previously discussed, is  
2 preferably to interpretable script, because it can be executed faster. Code 503 may  
3 include calls to one or more public methods 311. Customization 320 may contain a  
4 component corresponding to each and every event in public object model 302, or it  
5 may contain components corresponding to only a proper subset of the events in  
6 public object model 302. For example, some events 312 fired by application 201a  
7 may not be of interest to a particular customization. Continuing with the previous  
8 example, an event that is fired upon computation of the subtotal may not be of  
9 interest to a customization for use in a jurisdiction that has no sales tax, since no tax  
10 computation needs to be performed in response to computation of the subtotal.

11 One purpose of customizations 320 is to allow a single application  
12 object 201a to behave in a different ways depending on the different needs of  
13 different users. Thus, customization store/database 202 preferably stores a plurality  
14 of customizations 320. FIG. 6 shows a customization store/database 202 storing a  
15 plurality of customizations 320(1) through 320(n). Customization store/database 202  
16 also includes, or is associated with, a directory 601, that allows customizations  
17 320(1) through 320(n) to be indexed by attributes 602. Thus, application object  
18 201a may request a customization 320 by forming a database query, in response to  
19 which database 202 retrieves an appropriate customization 320 for use with  
20 application object 201a. It should be noted that the attributes 602 shown in FIG. 6  
21 are in the form of "monikers." Monikers are further discussed below, and they are  
22 a particularly advantageous way in which to index customizations 320 in  
23 customization store/database 202, although it will be appreciated that customizations  
24 320 may be indexed in database 202 in any manner without departing from the spirit  
25 and scope of the invention.

26 Returning to FIG. 3, application 300 further includes a customization  
27 object 303, which communicates with application object 201a. Customization object  
28 has access to public object model 302, and is invoked by the firing of events in

1 internal object 301. Customization object 303 includes one or more event handlers  
2 304 and start-up code 305. Start-up code 305 is code that “connects” customization  
3 object 303 with application object 201a upon invocation of customization object  
4 303, in the sense that start-up code 305 initializes customization object 303 such that  
5 customization object 303 can process events for application object 201a.

6 FIG. 7 shows the process carried out by the architecture of FIG. 3 in  
7 order to execute a customizable application. First (step 701) a client, such as client  
8 180a, requests a service that is performable by application object 201a. For  
9 example, if application object 201a is a program that prepares invoices, then the  
10 request may be a request for a new blank invoice form that can be filled out on  
11 client 180a. In response to this request, a user interface is retrieved and composed  
12 at step 702. The user interface may be part of application 300, or may be provided  
13 by a separate server program (such as a “web server”) operating in conjunction  
14 with application 300. At step 703, the user interface is presented to client 180a.

15 At step 704, a user is given the opportunity to interact with the  
16 interface (using client 180a). For example, the user may use the interface to fill in  
17 blanks in an invoice. The user’s interaction is transmitted back to application 300.

18 At step 705, an instance of application object 201a is created and  
19 initialized. The application object 201a is instantiated in a process by the host  
20 operating system (or other operating environment) or by a service operating on  
21 behalf of the operating system. The created instance of application object 201a will  
22 be used to process whatever information the user provides at step 704. It will be  
23 appreciated that the interaction at step 704 may be an ongoing process, and  
24 application object 201a may be instantiated during that interaction (in order to  
25 process an ongoing interaction) rather than waiting for the interaction at step 704 to  
26 finish.

27 At step 706, customization object 303 is created and initialized, and a  
28 particular customization 320 is located and retrieved from customization



1 store/database 202. As discussed above, this location and retrieval is preferably  
2 performed by application object 201a generating a database query and forwarding  
3 that query to customization store/database 202. The query is then processed by  
4 customization store/database 202 in order to locate and retrieve a particular  
5 customization 320. Either the customization itself, or a pointer or “handle” to such  
6 customization 320, is then provided to customization object 303, so that  
7 customization object 303 can use the retrieved customization 320 to process events.

8 At step 707, customization object 303 “connects” the retrieved  
9 customization 320 to application object 201a – i.e., it enables the components  
10 501(1) through 501(n) of the retrieved customization to respond to events 312  
11 generated by application object 201a. More specifically, event handlers 304 are set  
12 up to receive information generated during the course of application object 201a’s  
13 execution that signifies that events 312 have been fired by application object 201a.  
14 When the customization 320 is compiled, (for example by a script engine) startup  
15 object 305 is created. The startup object has a method that is called that assigns  
16 pointers to event handlers 304 to event sources 312. During the normal course of  
17 application object 201’s execution, any such connected event handlers 304 will be  
18 invoked. In addition, the startup method is provided a pointer to the public object  
19 model 302 and stored in a memory location that is accessible to the customization  
20 320.

21 At step 708, the logic in application object 201a begins to execute.  
22 The logic that executes includes internal object 301. For example, one of the  
23 sequences 410(1) through 410(n) (shown in FIG. 4) may begin to execute, which  
24 may include some predetermined actions 401 and the firing of some events 312. At  
25 some point during the execution of such a sequence, an event 312 is fired (step  
26 709). In response to the firing of an event, the event handler 304 is invoked,  
27 thereby causing customization object 303 to invoke one of components 501(1)  
28 through 501(n) of customization 320 (step 710). The particular component chosen

1 for invocation is determined by the particular event fired; it will be recalled that  
2 each component includes a method body 502 that is connected to the event 312  
3 being fired.

4 It will be appreciated at this point that, since the code of  
5 customization 320 is in binary form, all that needs to be done in order to invoke it is  
6 to load it in to the relevant address space and to execute it. These processes are  
7 readily apparent to one of skill in the art, and therefore need not be provided herein.

8 Also at step 710, the chosen component of customization 320  
9 completes execution, and control of the program is returned to the internal object  
10 301 of application object 201a. At this point step 708 is repeated, and the process  
11 continues until another event fires at step 709, or until application object 201a  
12 terminates (e.g., by completing execution of its instructions, or being terminated by  
13 the user).

#### 14 Monikers

15 As discussed above, at step 706 a customization 320 is selected for  
16 use with application object 201a. Customization 320 may be selected by any means,  
17 and according to any criteria, but a particularly useful technique includes the use of  
18 monikers to form a database query. Preferably, the monikers are dynamically  
19 constructed during the running of application object 201a.

20 A “moniker” is a multi-part string that uniquely identifies the  
21 customization that is directly relevant to that particular invocation of the business  
22 object. The exact composition of the moniker is determined by the application’s  
23 behavior and requirements. One application could, theoretically, have the same  
24 customization for all invocations of a given application object 201a. Another  
25 application can have different customizations for the same application object; for  
26 example, the customization can differ by user credentials (“per-user  
27 customization”). In the latter example, one sub-part of the moniker would contain  
28

1 the user's well-known handle ("user name") so that the customization that is  
2 directly relevant to that user can be loaded and invoked. This moniker scheme not  
3 only allows the invocation of a directly relevant customization; it also allows the  
4 storage mechanism for the customization (whether it be in source or binary form) to  
5 be identified by that same moniker. The moniker can be decomposed by a load and  
6 storage system (such as customization store 202) such that some or all of the  
7 moniker sub-parts can be used to do a "lookup" in the storage system to find a  
8 unique location to store or retrieve that customization.

9 Referring now to FIG. 8, an example moniker 800 includes one or  
10 more fields 801. In FIG. 8, fields are shown as being separated by slashes.  
11 Preferably, the fields include both fixed data 802 and environmentally-derived data  
12 803. Fixed data 802 is data that is known to application object 201a, and  
13 unchanging across different instantiations of application object 201a.  
14 Environmentally-derived data 803 is data that may be derived from the world  
15 outside of application object 201a. Environmentally-derived data 803 may vary  
16 across instantiations of application object 201a, since application object 201a may  
17 be instantiated in different environments.

18 In the example shown in FIG. 8, the fields based on fixed data 802  
19 include a company name ("XYZ"), application name ("A3"), module ("Acctg"),  
20 and application object name ("Invoice"). These exemplary are derivable from  
21 "fixed" data because it is generally the case that an application object 201a knows  
22 the name of the company (or other entity) at which it has been installed, the name of  
23 the application and application module of which it is a part, and its own name.  
24 These facts may be represented as fixed data that exists in application 201a's binary  
25 file; thus, this data is available to every instantiation of application object 201a.  
26 Environmentally-derived data 803 in the example of FIG. 8 includes a department  
27 name ("widgets"), and a user name ("joe"). For the purpose of the example, it is  
28 presumed that the XYZ company has a "widgets" department, and that "joe" is a

1 member of the widgets department. Furthermore, it is assumed that the A3  
2 application and its modules and application objects have been installed for company-  
3 wide (rather than department-specific or user-specific) use, and thus that they do not  
4 have fixed data representing a department or user because this information would  
5 change with every instantiation. However, it is assumed that the department and  
6 user on whose behalf application object 201a is instantiated is part of the  
7 environment in which that instantiation occurs, and thus can be obtained by  
8 querying that environment.

9           FIG. 9 shows application object 201a instantiated in an operating  
10 environment 901. Operating environment 901 may be an operating system such as  
11 operating system 134 (shown in FIG. 1), and it may have a "profile" that describes  
12 the user (and organization) of a particular computer on which it runs. In the  
13 example of FIG. 9, it is shown that the department ("widgets") and user ("joe") are  
14 attributes 902 of operating environment 901, and that those attributes 902 are  
15 accessible to an application object 201a running within operating environment 901.  
16 Thus, application object 201a can obtain the department and user attributes 902 by  
17 querying operating environment 901.

18           The process of creating a moniker 800 from which a customization  
19 320 can be located and retrieved is now described with reference to FIG. 10. After  
20 application object 201a starts, it gathers or refers to its own fixed data 801. For  
21 example, application object 201a may collect the data describing the name of the  
22 company in which it is installed, the names of the application and module of which  
23 it is a part, and its own name. At step 1002, application object 201a proceeds to  
24 gather environmental data 802 by querying operating environment 901. This may be  
25 done, for example, by operating system routines that return the attributes of the  
26 currently-logged-in user, such as his login-name and the organization of which he is  
27 a part. At step 1003, the moniker string 800 is constructed using the fixed data 801  
28 and the environmentally-obtained data 802. As discussed above, FIG. 8 shows an

1 exemplary format of the moniker string 800, but a variety of formats could be used  
2 as well. It will be observed that the moniker string 800 shown in FIG. 8 is  
3 organized hierarchically, which may be a convenient format for monikers.

4 It will be observed that the process shown in FIG. 10 is, in essence,  
5 a convenient way of performing step 706 in FIG. 7. As noted in connection with  
6 FIG. 7, a particular customization 320 may be located in customization store 202 in  
7 any manner, but it is particularly convenient to index and locate customizations 320  
8 by using monikers 800, and, in many contexts, it may be particularly advantageous  
9 for monikers 800 to be organized hierarchically in the manner shown in FIG. 8.

10 FIG. 11 shows an exemplary component that can be used during step  
11 706 (of FIG. 7) to lookup and retrieve a customization 320 based on a moniker 800.  
12 After application object 201a constructs a moniker 800 based on the process shown  
13 in FIG. 10, moniker 800 may be passed to a lookup component 1101, which  
14 constructs a database query 1102 that either includes, or is based on, moniker 800.  
15 The format of the query depends on the particular database (or other type of system)  
16 that is used to implement customization store 202. As one non-limiting example, if  
17 customization store 202 is implemented using a MICROSOFT SQL database, then  
18 the query should be in a format such that it can be processed by such a database.  
19 When the query is passed to customization store 202, the query is processed, and a  
20 customization 320 (or reference thereto) is returned to lookup component 1101. The  
21 lookup component then returns to customization object 303 a "handle" 1103 that  
22 can be used to actuate the various components 501(1) through 501(n) of  
23 customization 320.

24 Lookup component 1101 may be invocable using the hypertext  
25 transport protocol (HTTP) and the simple object access protocol (SOAP). Thus,  
26 when it is necessary to retrieve a customization 320, the requesting component  
27 (e.g., application object 201a) can simply call lookup component 1101 with a  
28 particular moniker 800 using HTTP and SOAP. This provides a level of abstraction

1 over the details of how or where customization store 202 is implemented. Since  
2 HTTP can be used to communicate with both local and remote objects, the same  
3 call to lookup object 1101 can be used whether customization store is a local  
4 database residing on the same computing device that executes application object  
5 201a, or some other information storage means such as a file system on a remote  
6 computer.

7 It will be apparent to those of skill in the art that lookup component  
8 1101 may be implemented as a software module running on a computer, such as the  
9 computer that runs application object 201a. Moreover, the details of how to convert  
10 a string (such as moniker 800) into a database query would be apparent to those of  
11 skill in the art and thus the code for such is not provided herein.

#### 12 13 Creation of a Customization: Design Time

14 FIG. 12 shows an exemplary process by which a customization 320  
15 may be created for use with application object 201a. At step 1201, a programmer  
16 who desires to write a customization for use with application object 201a accesses  
17 the public object model 302, which, as discussed above, includes a list of public  
18 methods 311 and a list of events 312 that are fired by application object 201a. It will  
19 be observed that a well-designed application object 201a will have events in  
20 “interesting” places – i.e., points during the operation of application object 201a  
21 where users may wish to perform additional custom actions. The exact placement of  
22 events within application object 201a is determined by the nature of the task that  
23 application object 201a is designed to perform. As previously indicated, if  
24 application object 201a is designed to prepare invoices, then an example of a useful  
25 place for an event is following the computation of the subtotal.

26 At step 1102, the programmer creates customized code that “hooks  
27 into” application object 201a by using the events 312 and method 311 specified in  
28 public object model 302. For example, the public object model may indicate that, at

1 some point during its execution, application object 201a will invoke an event 312  
2 called "EventA" and that EventA takes an integer value as a parameter. In this  
3 case, the programmer can write a function called "EventA" which accepts an  
4 integer value as a parameter, and which performs some operations specified by the  
5 programmer. The programmer may also use public methods 311 in writing the code  
6 that responds to events. For example, public object model 302 may disclose that  
7 application object 201a exports a method called "Subtotal" whose return value is the  
8 subtotal of all items on an invoice, and this method may be called in the code that  
9 the programmer write – for example, in the code for the custom-written function  
10 called "EventA."

11 A programmer may be assisted in the performance of step 1202 by  
12 the use of a "script engine" which compiles textual descriptions of instructions into  
13 machine-readable instructions. The script engine may also insert or inject other code  
14 (such as start-up code 305, shown in FIG. 3) into the binary form of customization  
15 320. This extra code is not generated by the programmer, but rather is inserted by a  
16 special purpose script engine that is designed to compile programs in a manner such  
17 that they can work with an application object 201a in the manner described herein.  
18 For example, the start-up code 305 generated by the script engine may enable the  
19 linking of event handler(s) 304 with the event(s) 312 fired by application object  
20 201a. Start-up code 305 may also contain a globally accessible variable that contains  
21 a pointer or "handle" to public object model 302 of application object 201a. The  
22 script engine will generate the aforementioned code in a source language that it  
23 itself understands and then compile it to binary form along with the  
24 customization(s).

25 At step 1203, the compiled code is inserted into a customization  
26 store/database 202. As noted above, the code is preferably in binary form at this  
27 point, which allows for it to be loaded and executed faster than if it were stored as  
28 an interpretable script. However, it should be noted that customization

1 store/database 202 can also store customization code in a source-level language, in  
2 which case the code may be compiled “on the fly” as it is retrieved from  
3 customization store/database 202.

4 At step 1204, the customized code is indexed in the database. The  
5 indexing may, for example, be by rows and columns (or by additional dimensions in  
6 a more-than-two-dimensional matrix). Preferably, the manner in which a  
7 customization is indexed is closely related to its moniker 800. For example, each  
8 dimension of the matrix may represent a particular field 801 in the moniker 800 for  
9 customization 320. The process of indexing the customization 320 may, in fact,  
10 begin with the process of creating a moniker 800 for the customization. For  
11 example, the programmer may be queried as to what application, module,  
12 department, user, etc., the customization applies to, so that a moniker 800 can be  
13 created on this basis.

14 Once the customization 320 is stored in customization store/database  
15 202 and indexed therein, it is available to be called by application object 201a in  
16 appropriate circumstances.

17 It is noted that the foregoing examples have been provided merely for  
18 the purpose of explanation and are in no way to be construed as limiting of the  
19 present invention. While the invention has been described with reference to various  
20 embodiments, it is understood that the words which have been used herein are  
21 words of description and illustration, rather than words of limitations. Further,  
22 although the invention has been described herein with reference to particular means,  
23 materials and embodiments, the invention is not intended to be limited to the  
24 particulars disclosed herein; rather, the invention extends to all functionally  
25 equivalent structures, methods and uses, such as are within the scope of the  
26 appended claims. Those skilled in the art, having the benefit of the teachings of this  
27 specification, may effect numerous modifications thereto and changes may be made  
28 without departing from the scope and spirit of the invention in its aspects.



CLAIMS

## WHAT IS CLAIMED IS:

1. A customizable application object adapted to bind to one of a plurality of customization objects, said customizable application object comprising:

a base object having:

internal logic executable on a computing device, said internal logic causing said computing device to perform one or more actions, said one or more actions including the signifying of one or more events; and

a public object model which includes identifiable references to said one or more events; and

a customization object having:

data or logic representative of said public object model; and

an event handler which receives the signified events from said base object, and which invokes at least one customized code sequence based on said data or logic.

2. The customizable application object of claim 1, wherein said customized code sequence comprises machine-executable binary code.

3. The customizable application object of claim 1, wherein said event handler invokes said customized code sequence further based on which of said one or more events is signified by said internal logic.

4. The customizable application object of claim 1, wherein said customization object further comprises a plurality of event handlers, each of said event handlers corresponding to one of said one or more events, each event handler

being invocable upon the signification of the corresponding event.

5. The customizable application object of claim 1, wherein said base object further comprises:

logic which retrieves said customized code sequence from a database which stores a plurality of customized code sequences, the retrieval being based on a query.

6. The customizable application object of claim 5, wherein said base object further comprises:

logic which generates said query.

7. The customizable application object of claim 5, wherein said base object further comprises:

logic which derives information from attributes external to said customizable application object,  
whereby the retrieval is based at least in part on the derived information.

8. The customizable application object of claim 1, wherein said customization object further comprises:

data or logic which links said customization object to said base object such that said event handler may respond to one or more events signified by said internal logic.

9. A method of performing a task on a computing device, said task including one or more fixed actions and one or more variable actions, said method comprising the acts of:

performing said one or more fixed actions:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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for each of said variable actions, signifying an event;  
selecting a custom code module from a plurality of custom code modules, each of said custom code modules comprising one or more executable components, each of said executable components corresponding to one of said variable actions; and  
in response to each of said events, invoking a first executable component from the selected custom code module, said first executable component corresponding to the variable action signified by the event.

10. The method of claim 9, wherein said selecting act comprises:  
submitting a query to a database, wherein said database contains said plurality of custom code modules; and  
receiving the selected custom code module from said database, or a reference to said custom code module.

11. The method of claim 10, further comprising the act of creating a moniker which identifies a code module, wherein said query is based on said moniker.

12. The method of claim 11, wherein said method is performed within an operating environment, and wherein said act of creating a moniker further comprises deriving information from said environment, said moniker being based at least in part on said environment.

13. The method of claim 9, further comprising the act of loading the selected code module into a memory on said computing device.

14. The method of claim 9, wherein said custom code module is in a

1 machine-executable format.

2  
3 15. The method of claim 9, further comprising the act of contacting a  
4 remote server to obtain the selected custom code module.

5  
6 16. A computer-readable medium having computer-executable  
7 instructions to perform the method of claim 9.

8  
9 17. A method of performing a task on a computing device, said task  
10 including a set of predetermined actions and at least one externally-definable action,  
11 said method comprising the acts of:

12 performing said set of predetermined actions;  
13 generating a database query;  
14 retrieving, based on said database query, a code module from  
15 a database, said code module including a first set of instructions which perform said  
16 externally-definable action;  
17 loading the retrieved code module; and  
18 invoking said first set of instructions.

19  
20 18. The method of claim 17, further comprising the act of generating  
21 a moniker string which identifies a code module, and wherein said act of generating  
22 a database query comprises basing said database query on said moniker string.

23  
24 19. The method of claim 18, wherein said moniker string is based at  
25 least in part on fixed data.

26  
27 20. The method of claim 18, further comprising the act of deriving  
28 information from an environment in which said predetermined actions are

1 performed, wherein said moniker string is based at least in part on the derived  
2 information.

3  
4 21. The method of claim 17, wherein said database provides a  
5 pointer to said code module, and wherein said act of retrieving said code module  
6 comprises following said pointer.

7  
8 22. The method of claim 17, further comprising the act of generating  
9 an event, wherein said act of invoking said first set of instructions is performed in  
10 response to the generating of said event.

11  
12 23. The method of claim 17, wherein said code module comprises a  
13 plurality of sets of instructions, and wherein said method further comprises the act  
14 of selecting a set of instructions from among said plurality of sets of instructions.

15  
16 24. The method of claim 23, further comprising the act of generating  
17 a predetermined one of a plurality of events, wherein the selection of a set of  
18 instructions from among said plurality of sets of instructions is based on which one  
19 of said plurality of events is generated.

20  
21 25. The method of claim 17, wherein said code module is in a  
22 machine-executable format.

23  
24 26. A computer-readable medium having computer-executable  
25 instructions to perform the method of claim 17.

26  
27 27. A system for performing a customizable task comprising:

28 a database having query processing logic which receives a

query specifying identifying data and which retrieves items from said database based on said query, said database storing a plurality of custom code modules, said database having a directory which indexes each of said custom code modules by identifying data; and

a software object having:

logic which performs one or more predetermined actions; and

logic which requests information from said database  
based on first identifying data;

logic which receives a custom code module from said database in response to the request; and

logic which loads the received custom code module for execution.

28. The system of claim 27, wherein said software object further comprises logic which generates an event, wherein said custom code module contains instructions which execute in response to the generation of said event.

29. The system of claim 28, wherein said event is a member of a group of events, wherein said custom code module includes one or more components each of which corresponds to one of said group of events, and wherein said system further comprises logic which invokes one of said components based on which of said events is generated.

30. The system of claim 27, wherein said software object further comprises logic which invokes the execution of said custom code module or portion thereof.

1           31. The system of claim 27, wherein said software object further  
2 comprises logic which generates a moniker string that identifies said custom code  
3 module, and wherein said first identifying data includes or is based on said moniker  
4 string.

5  
6           32. The system of claim 31, wherein said software object is  
7 executable in an operating environment, wherein said logic which generates a  
8 moniker string includes logic which retrieves one or more data from said operating  
9 environment, and wherein said moniker string is based at least in part on said one  
10 or more data.

11  
12           33. The system of claim 32, wherein said one or more data include  
13 the identity of a user or organization.

14  
15           34. The system of claim 27, wherein said database further includes:  
16               logic which receives said first identifying data, generates a  
17 database query based on said first identifying data, and forwards the generated  
18 query to said query processing logic.

19  
20           35. The system of claim 27, wherein said database is accessible to  
21 said software object via a remote access protocol.

22  
23           36. The system of claim 35, wherein said database is located  
24 remotely from a computing device that executes said software object.

25  
26           37. The system of claim 27, wherein said database stores said  
27 plurality of custom code modules in machines-executable format.

28

1           38. A method of customizing a software object which invokes one of  
2 a plurality of actions, said method comprising the acts of:

3                   creating a first set of computer-executable instructions which  
4 performs a first of said plurality of actions;

5                   storing said first set of computer-executable instructions in a  
6 database, said first set of computer-executable instructions being indexed in said  
7 database by first identifying data, said database being communicatively coupleable  
8 to said software object, said software object being adapted to query said database  
9 and to invoke computer-executable instructions stored in said database;

10                  creating a second set of computer-executable instructions  
11 which performs a second action; and

12                  storing said second set of computer-executable instructions in  
13 said database, said second set of computer-executable instructions being indexed in  
14 said database by second identifying data,

15 whereby said software object may query said database based on identifying data and  
16 invoke either said first or said second set of computer-executable instructions  
17 according to which of said sets of computer-executable instructions satisfies said  
18 query.

19  
20           39. The method of claim 38, wherein each of said first and second  
21 sets of instructions comprises a plurality of components, each of said components  
22 corresponding to one of a plurality of events generated during the operation of said  
23 software object.

24  
25           40. The method of claim 38, further comprising the act of  
26 generating, for each of said first and second sets of computer-executable  
27 instructions, a moniker string based at least in part on the identity of an entity on  
28 whose behalf the software object will invoke the set of computer-executable



1 instructions.

2  
3 41. The method of claim 40, wherein said identity comprises the  
4 name of an organization.

5  
6 42. The method of claim 41, wherein said identity comprises the  
7 name of a user.

8  
9 43. The method of claim 38, further comprising the act of compiling  
10 each of said first and second sets of computer-executable instructions prior to their  
11 storage in said database.

12  
13 44. In a software object executing within an operating environment, a  
14 method of locating a code module comprising the acts of:

15 ascertaining one or more attributes of said operating  
16 environment external to said software object;

17 generating a database query based at least in part on said one  
18 or more attributes;

19 querying a database using the generated database query, said  
20 database storing one or more code modules; and

21 receiving from said database either a first of said one or more  
22 code modules or a pointer to said first code module.

23  
24 45. The method of claim 44, wherein said software object comprises  
25 fixed data identifying said software object, and wherein act of generating a database  
26 query is further based on said fixed data.

27  
28 46. The method of claim 45, wherein said fixed data comprises the

1 name of said software object or of a sub-object thereof.

2  
3 47. The method of claim 44, wherein said one or more attributes  
4 include the identity of an entity associated with said operating environment.

5  
6 48. The method of claim 44, further comprising the act of executing,  
7 or invoking the execution of, the retrieved code module.

8  
9 49. A computer-readable medium having computer-executable  
10 instructions to perform the method of claim 44.

11  
12 50. A system for performing a customizable task comprising:  
13 means for performing one or more predetermined actions;  
14 means for signifying one or more events;  
15 means for storing a plurality of code modules;  
16 means for loading a selected one of said plurality of code  
17 modules; and  
18 means for invoking at least a portion of the selected code  
19 module in response to said one or more events.

20

**ABSTRACT OF THE DISCLOSURE**

An architecture for customizable applications includes an application object and a customization object. The application object has internal logic that performs a set of fixed or predetermined actions, and a public object model. The public object model includes a set of public methods that are invocable on the application object, and a set of event source which are methods that can be implemented by a programmer and are called by the internal logic of the application object. By implementing methods invocable by the event sources, it is possible to extend and customize the functionality of the application object. The customizations are stored in a customization database for retrieval during the dynamic operation of the application object. Each customization may be identified by a "moniker," which is a string having a hierarchical format. The moniker is derived partly from fixed data known to the application object, and partly from environmental data that is ascertained by the application object at run time.

Computer 100

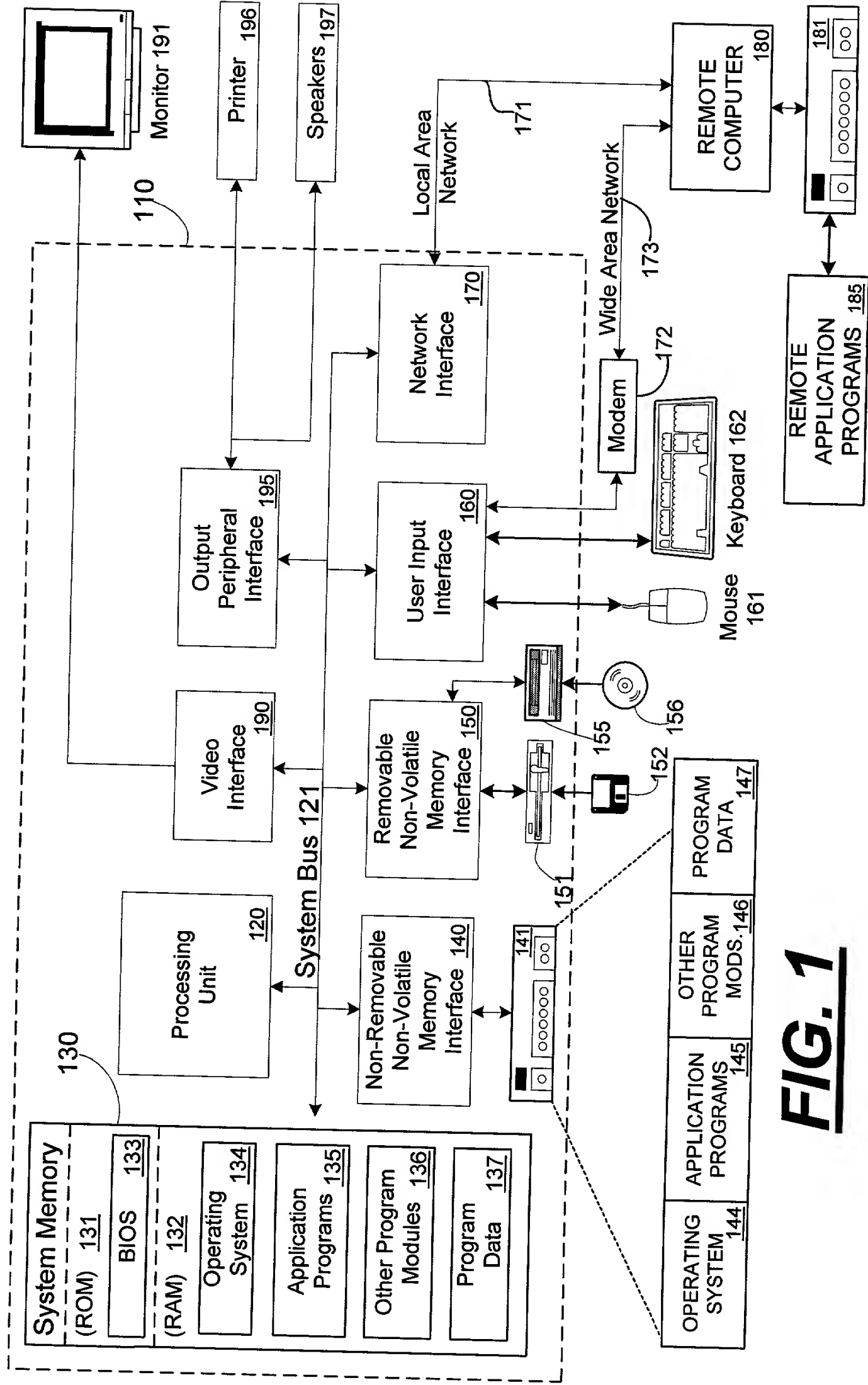
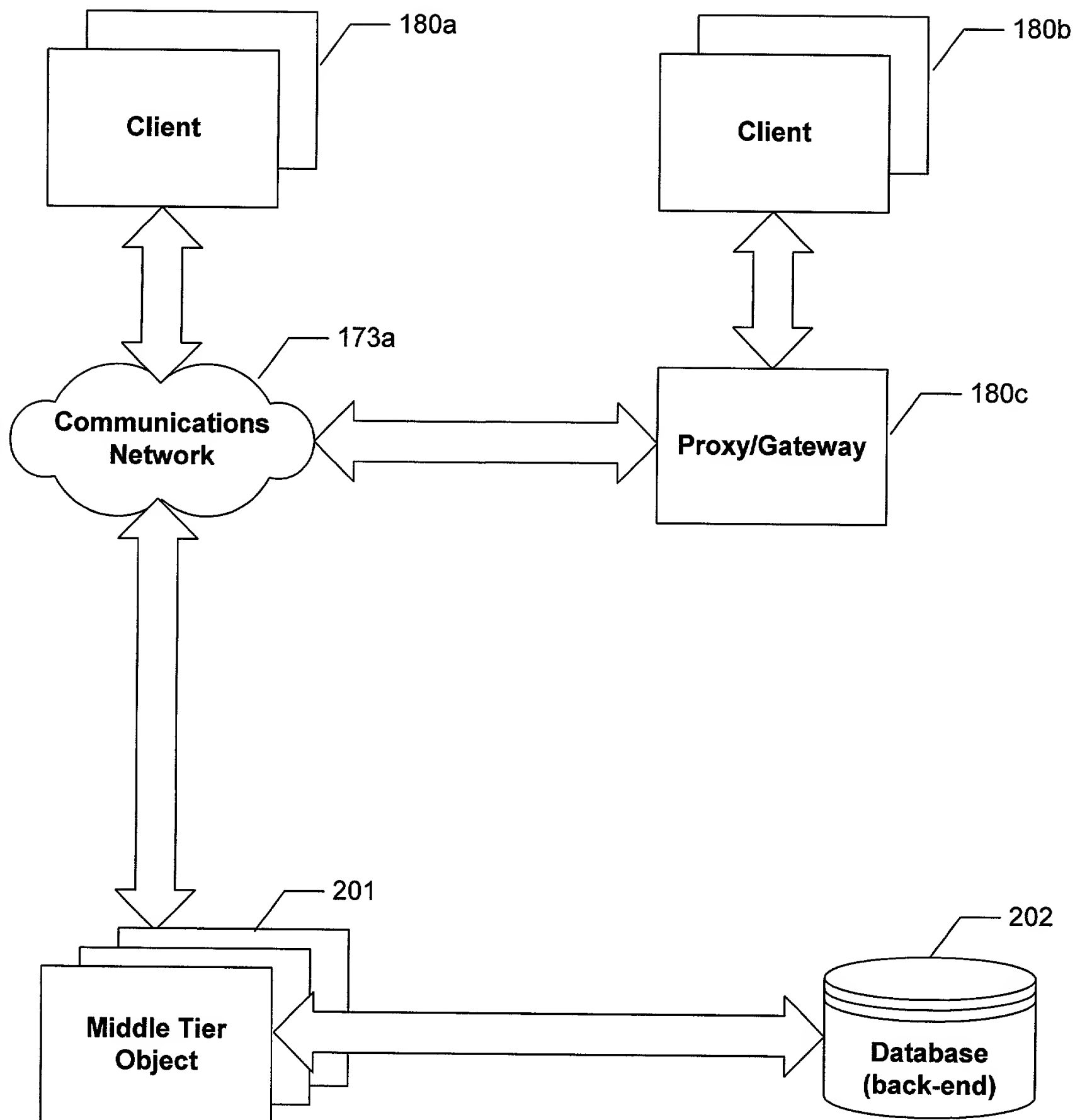
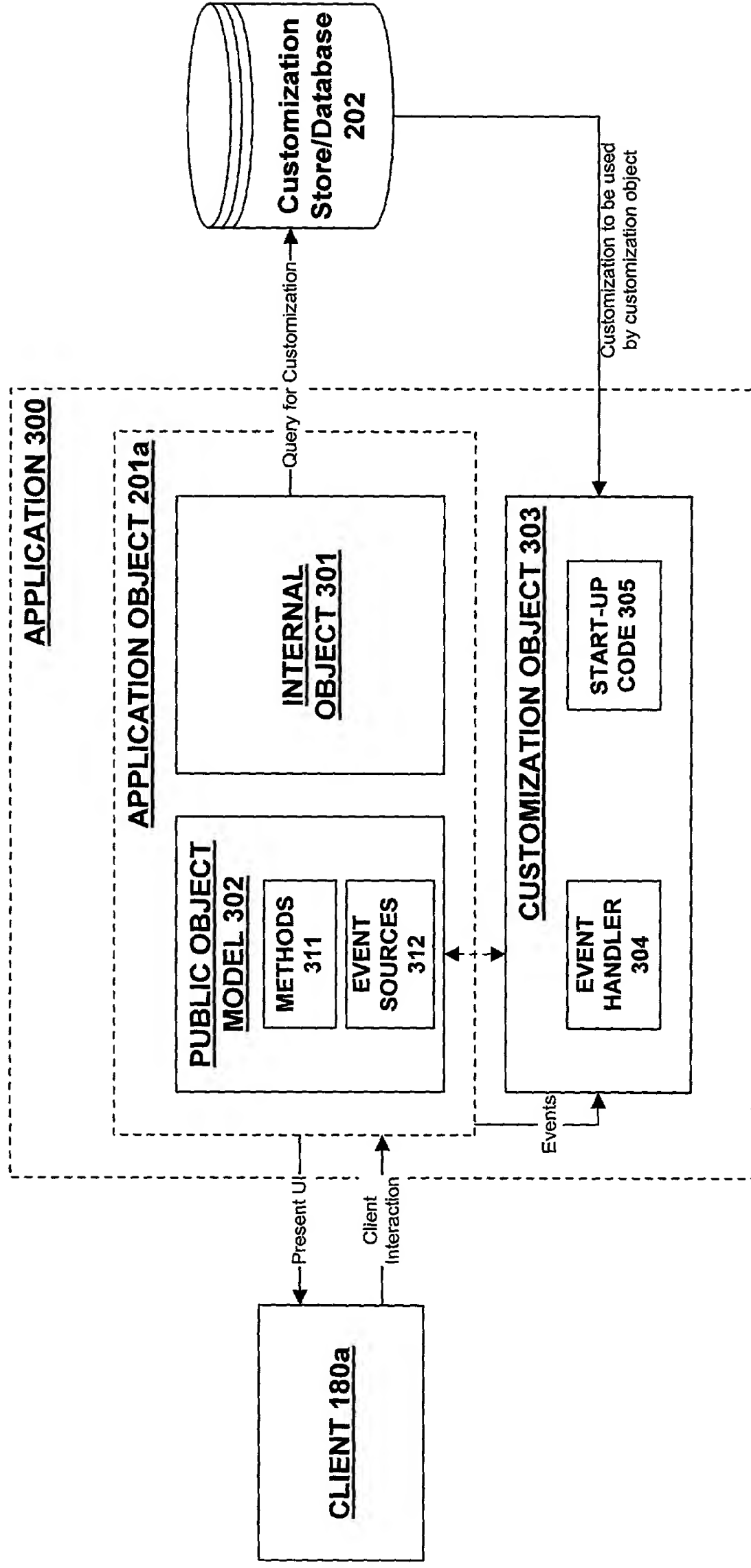


FIG. 1

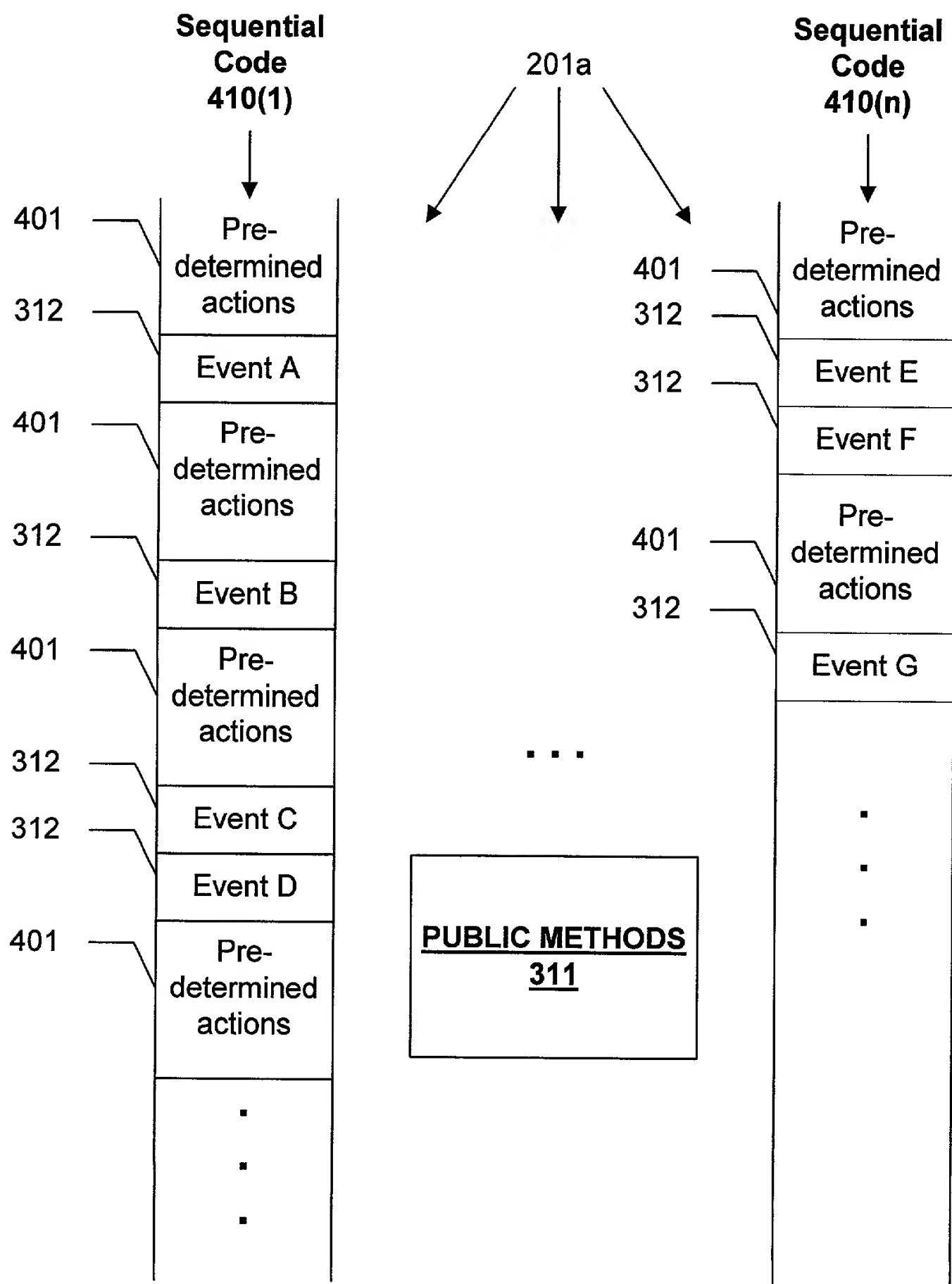
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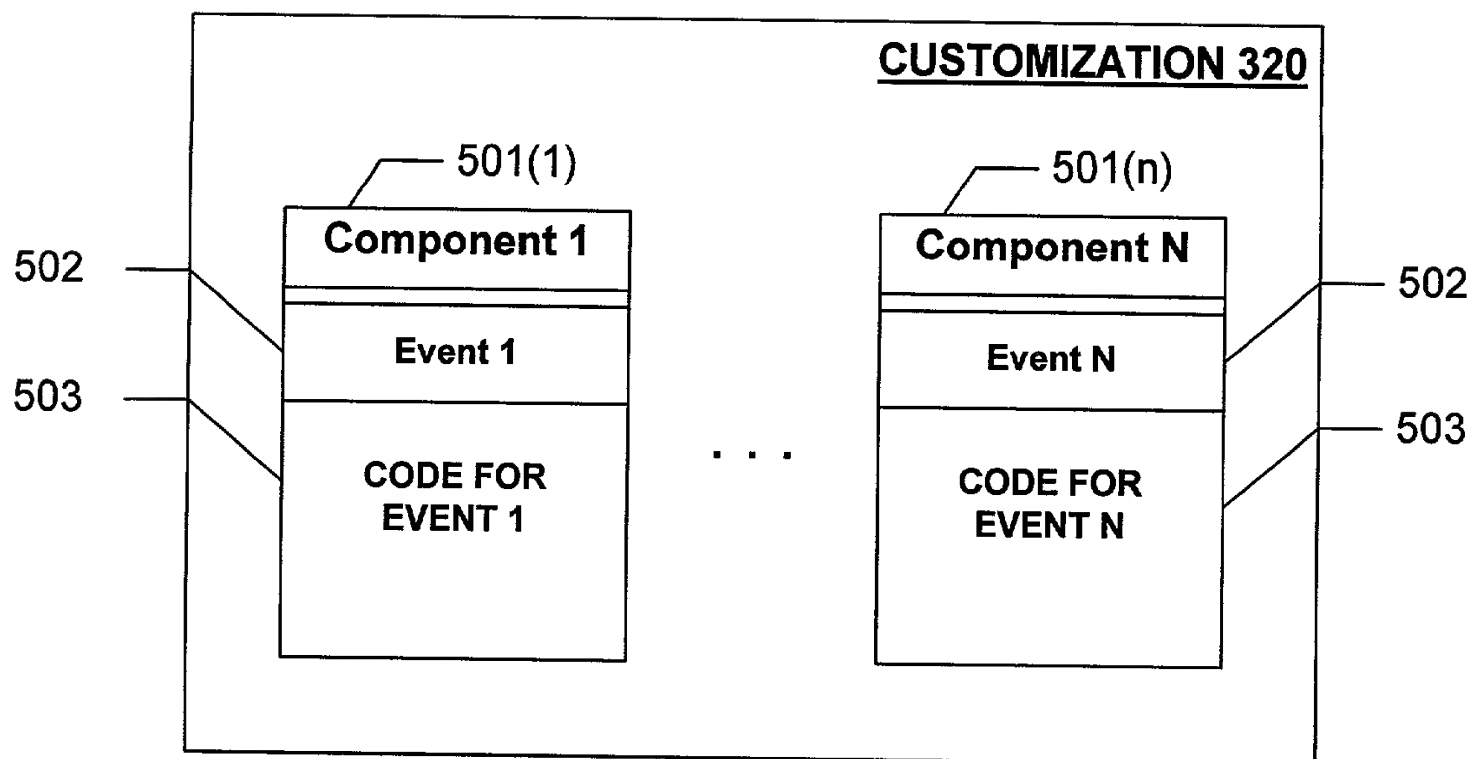
**FIG. 2**



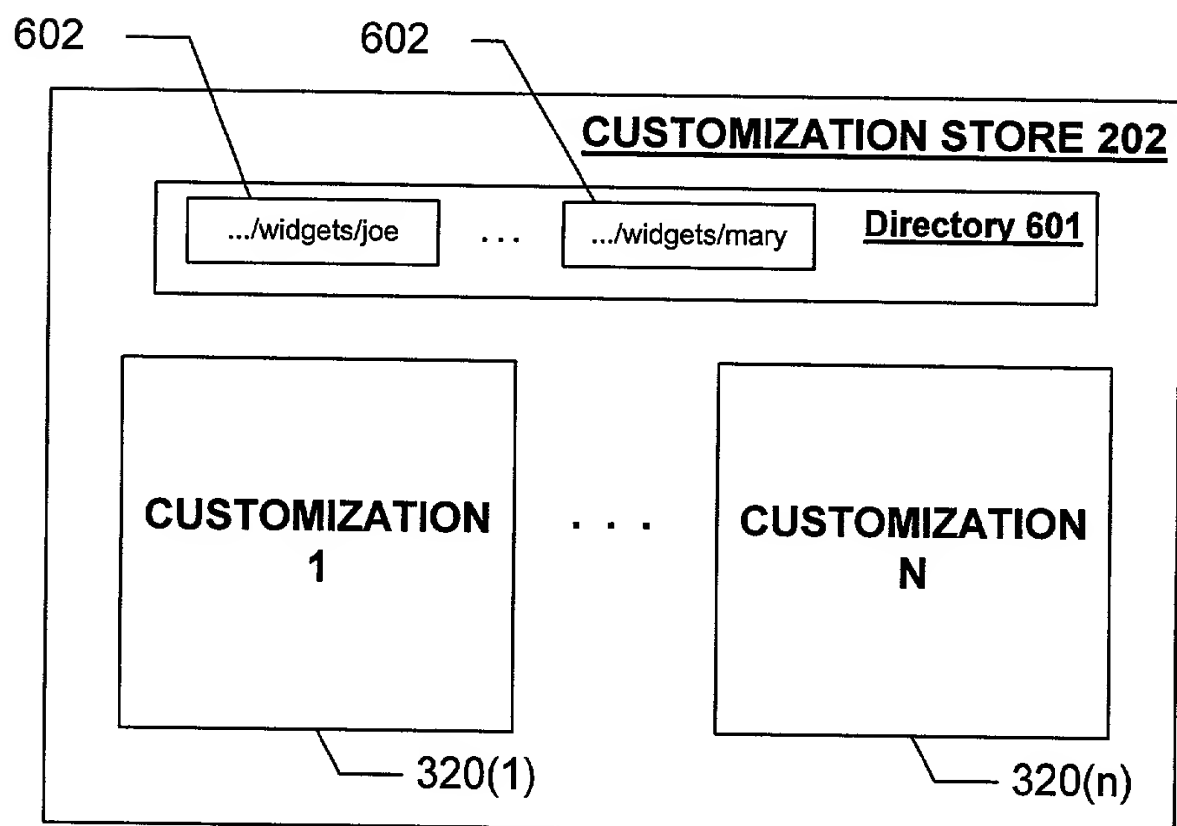
**FIG. 3**



**FIG. 4**



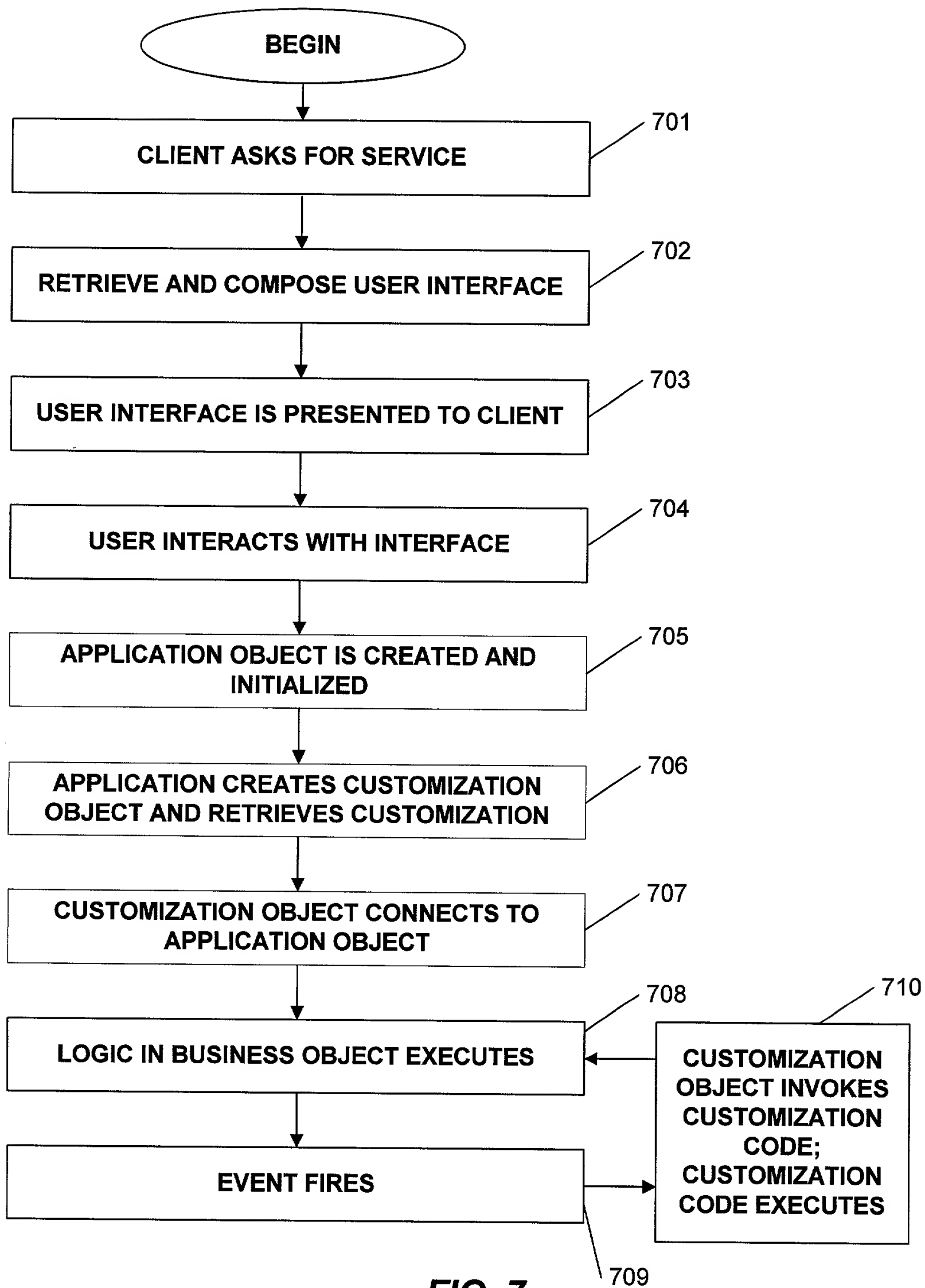
**FIG. 5**



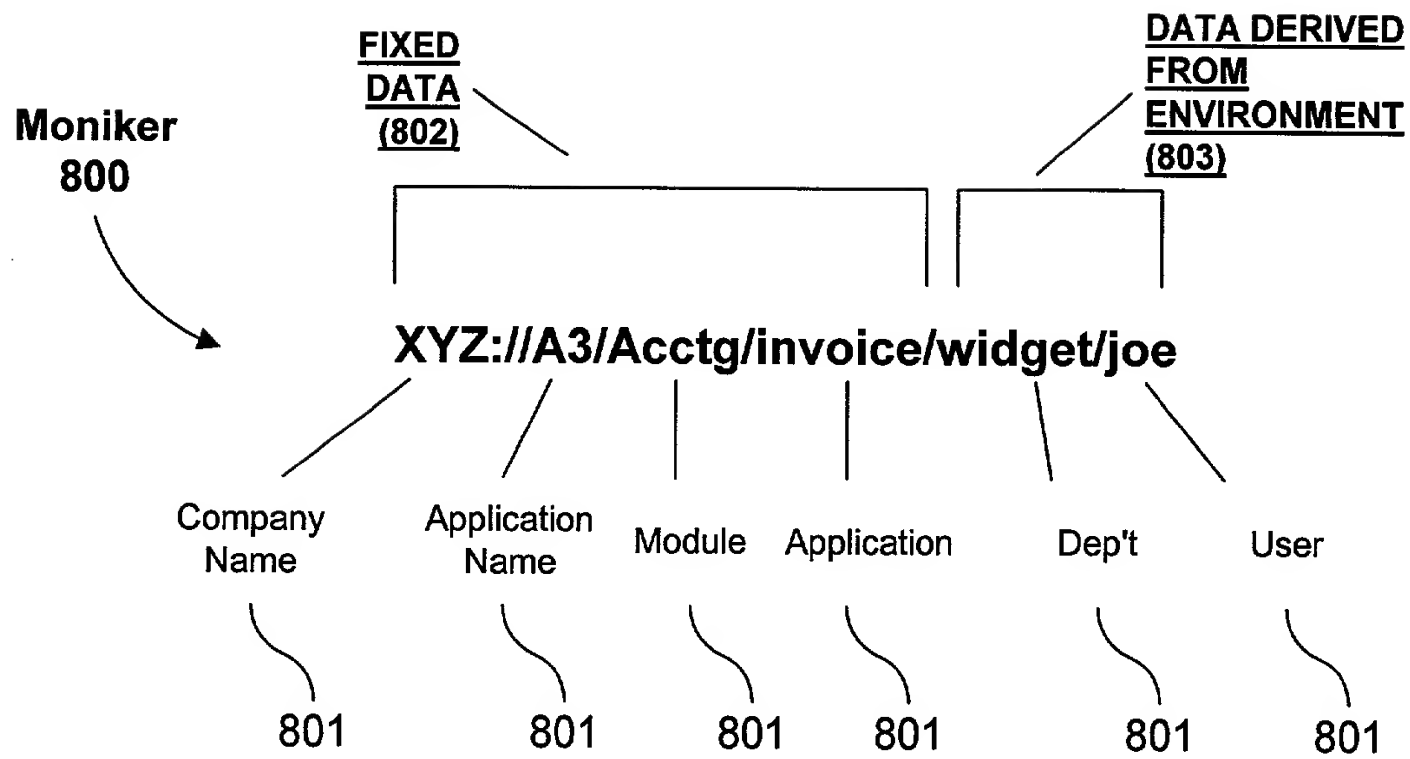
**FIG. 6**



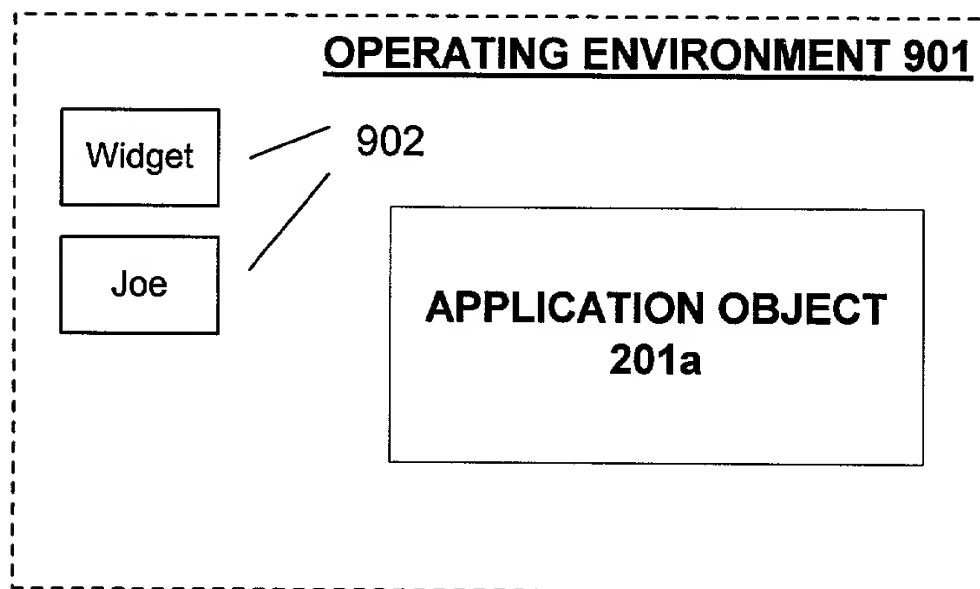
000001-1000



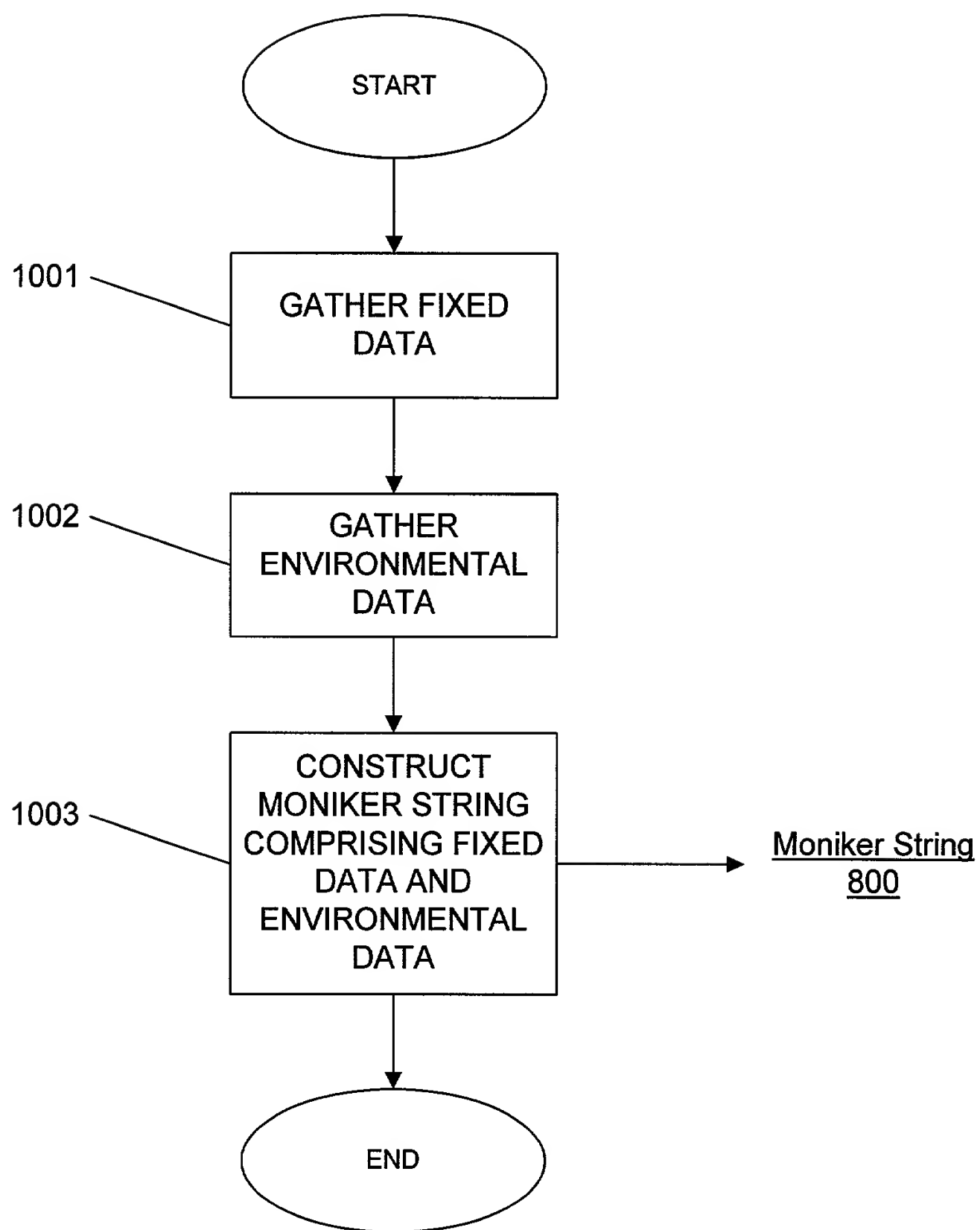
**FIG. 7**



**FIG. 8**

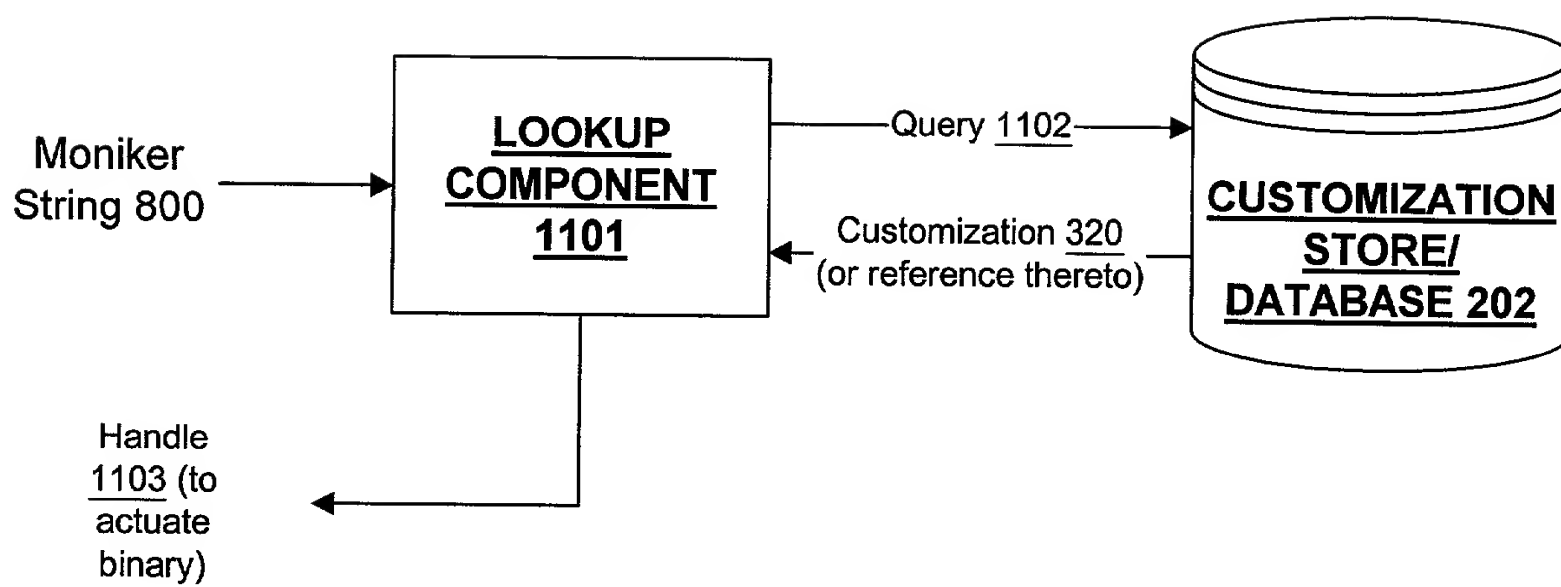


**FIG. 9**

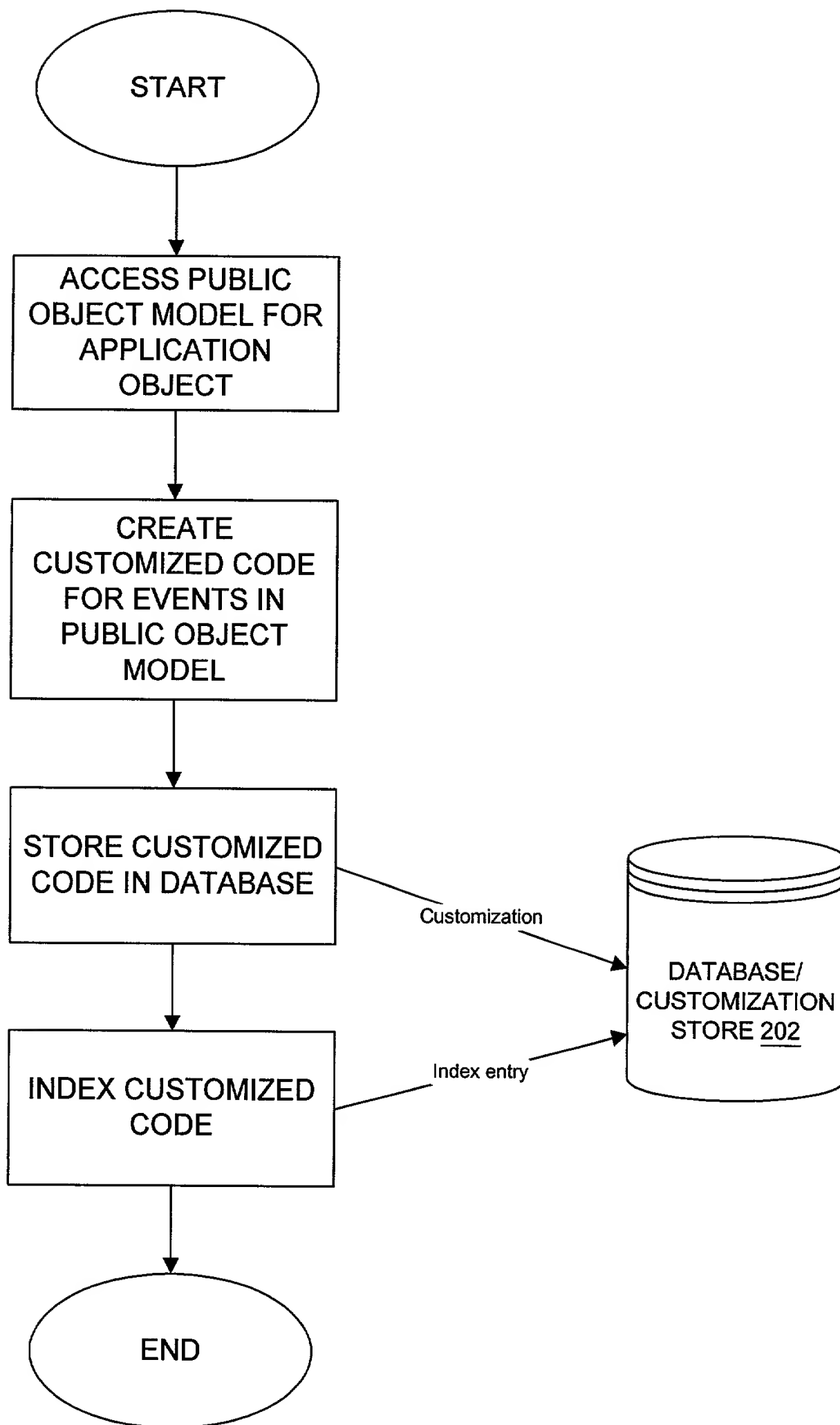


**FIG. 10**

000001-1582960



**FIG. 11**



**FIG. 12**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**In Re Application of:**

Elliot Omiya, Todd Jefferson and Andrew Clinick    **Group Art Unit:** Not Yet Assigned

**Examiner:** Not Yet Assigned

## For: ARCHITECTURE FOR CUSTOMIZABLE APPLICATIONS

## DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;  
and

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a

☒ Utility Patent

☐ Design Patent

is sought on the invention, whose title appears above, the specification of which:

☒ is attached hereto.

☐ was filed on \_\_\_\_\_ as Serial No. \_\_\_\_\_.

☐ said application having been amended on \_\_\_\_\_

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to be material to the patentability of this application in accordance with 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a-d) of any **foreign application(s)** for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of any application on which priority is claimed.

**Priority  
Claimed  
(If X'd)**

Country

## Serial Number

**Date Filed**


I hereby claim the benefit under 35 U.S.C. §120 of any **United States application(s)** listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to be material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

## Serial Number

**Date Filed**

### Patented/Pending/Abandoned


I hereby claim the benefit under 35 U.S.C. §119(e) of any United States **provisional application(s)** listed below:

### Serial Number

**Date Filed**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

I hereby appoint the following persons as attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

[illegible]

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

<b>Name:</b>  Elliot Omiya	<b>Signature:</b> _____  <b>Date of Signature:</b> _____  <b>Citizenship:</b> <u>United States of America</u>
<b>Mailing Address:</b> 719 4 <sup>th</sup> Street West Kirkland, WA 98033	
<b>City/State of Actual Residence</b> <b>Kirkland, WA 98033</b>	



